64 Cranial Nerve XI: The Spinal Accessory Nerve

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Definition

This nerve supplies the sternocleidomastoid and trapezius muscles, which have the following functions:

1. Rotation of head away from the side of the contracting sternocleidomastoid muscle.
2. Tilting of the head toward the contracting sternocleidomastoid muscle.
3. Flexion of the neck by both sternocleidomastoid muscles.
4. Elevation of the shoulder by the trapezius.
5. Drawing the head back so the face is upward by the trapezius muscles.

With weakness or paralysis these functions are decreased or absent. When the lesion is nuclear or infranuclear, there is associated muscle atrophy and fasciculations.

Technique

Observe the volume and contour of the sternocleidomastoid muscles as the patient looks ahead. Test the right sternocleidomastoid muscle by facing the patient and placing your right palm laterally on the patient's left cheek. Ask the patient to turn the head to the left, resisting the pressure you are exerting in the opposite direction. At the same time, observe and palpate the right sternocleidomastoid with your left hand. Then reverse the procedure to test the left sternocleidomastoid.

Continue to test the sternocleidomastoid by placing your hand on the patient's forehead and pushing backward as the patient pushes forward. Observe and palpate the sternocleidomastoid muscles.

Now test the trapezius. Ask the patient to face away from you and observe the shoulder contour for hollowing, displacement, or winging of the scapula. Observe for drooping of the shoulder. Place your hands on the patient's shoulders and press down as the patient elevates or shrugs the shoulders and then retracts the shoulders.

Basic Science

The eleventh nerve has two parts. The smaller cranial part arises from cells in the nucleus ambiguus and ultimately is distributed with the vagus nerve. This portion innervates the pharyngeal muscles. The main part, the spinal portion, arises from a long column of nuclei situated in the ventral part of the medulla and extending to the fifth cervical segment or lower. Supranuclear innervation is not well known. It has been characterized by authors as being ipsilateral, contralateral, or bilateral. It begins in the precentral gyri and descends in the corticobulbar tract. As the fibers leave the cord they join together and ascend through the foramen magnum, then leave through the jugular foramen with the vagus nerve. The nerve descends in the neck near the jugular vein and supplies the sternocleidomastoid and trapezius muscles, joined by motor or sensory contributions from the upper cervical nerves. Some recent insights into the supranuclear contributions are discussed in the Clinical Significance section below.

The sternocleidomastoid muscles originate from the sternum and clavicle and insert on the mastoid process. Each one (1) rotates the head to the opposite side of the body, that is, away from the side of the muscle; (2) tilts the head to the same side of the body. Acting together the sternocleidomastoid muscles flex the neck and bring the head forward and down.

The trapezius muscle originates on the occiput and the spinous processes of the cervical and thoracic vertebrae and inserts on the clavicle and scapula. Some controversy centers on whether all or part of the muscle is supplied by the spinal accessory nerve; many believe only its upper portion is supplied by the eleventh nerve. When the head is fixed, the trapezius elevates the shoulders. When the scapula is fixed, it draws the head ipsilaterally; jointly the trapezii pull the head back so the face is upward.

Clinical Significance

Supranuclear lesions of the eleventh nerve cause moderate, often transient, impairment of function of the sternocleidomastoid and trapezius muscles, due to the bilateral innervation. In the spinal cord the nuclei can be involved in amyotrophic lateral sclerosis, syringomyelia, polio, and intraspinal tumors. Occlusion of the vertebral or posterior inferior cerebellar artery produces infarction of the medullary tegmentum, with deficits of V, IX, X, and XI (Wallenberg's syndrome).

Nerves IX, X, and XI travel together in the jugular foramen. They may be compressed by tumors and aneurysms (Vernet's syndrome). The XII nerve may also be involved in more extensive lesions occurring in the posterior laterocondylar space (syndrome of Collet-Sicard); causes include parotid tumors, carotid body tumors, adenopathy of whatever cause, and tuberculosis involving the lymph nodes. Sarcoidosis is another cause. A similar set of etiologies can damage the same four nerves (IX, X, XI, XII) in the posterior retroparotid space (Villaret's syndrome).

Isolated lesions of the spinal accessory nerve are rare. Surgical injury is one cause. The eleventh nerve crosses the posterior triangle of the neck lying on the levator scapulae, and it is quite vulnerable to surgical procedures in that area, such as biopsy or exploration. Involvement can occur some time following surgery, suggesting entrapment by scar tissue. An idiopathic mononeuropathy manifested by pain along the posterior border of the sternocleidomastoid mus-

cle followed by weakness has been reported. Radiation can cause injury, with or without involvement of other nerves. Some unusual causes have been reported: injury during attempted hanging; love-play bites during sex.

A recent report of three cases of dissociated weakness of the sternocleidomastoid and trapezius muscles has provided insight into the neuroanatomy of the spinal accessory nerve (Manon-Espaillat and Ruff, 1988). The following comments are based upon these cases in addition to previous anatomical findings. The nuclei to the sternocleidomastoid and trapezius muscles appear to be somatotopically arranged in the cervical cord. Motor neurons at C1–2 innervate the sternocleidomastoid, while neurons at C3–4 innervate the trapezius. This innervational pattern can account for isolated weakness of one muscle or the other.

The supranuclear innervation to motor neurons for each of the muscles appears to take different courses. Supranuclear fibers from the precentral gyrus destined for the sternocleidomastoid descend in the brainstem tegmentum, while fibers going to the trapezius motor neurons are in the ventral brainstem. Consequently, restricted lesions in these locations can produced dissociated weakness of the two muscles.

The supranuclear fibers to the sternocleidomastoid appear to have a double decussation in the brainstem. The first occurs caudal to the oculomotor complex in the pontine tegmentum, and the second at the cervicomedullary junction (Bender, Shanzer and Wagman, 1964). Therefore at this level a single lesion can produce an ipsilateral sternocleidomastoid weakness and contralateral trapezius weakness.

These findings lead to the following clinical generalizations with reference to localization (Manon-Espaillat and Ruff, 1988):

- Trapezius weakness on one side and sternocleidomastoid weakness on the contralateral side indicate an upper motor neuron lesion ipsilateral to the involved sternocleidomastoid and above the oculomotor nerve nucleus
- Trapezius muscle weakness with sparing of the sternocleidomastoid points to a lesion in the ventral brainstem, lower cervical cord, or lower spinal accessory roots
- Sternocleidomastoid weakness alone indicates a brainstem tegmentum or upper cervical accessory root lesion
- Weakness of both muscles ipsilaterally can be produced by a lesion in the contralateral brainstem, ipsilateral high cervical cord, or an accessory nerve lesion peripherally before the nerve bifurcates to both muscles
- A peripheral lesion distal to the bifurcation also produces weakness involving only one muscle

Detailed discussions and further sources may be found in the References.

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